3GPP TSG-RAN WG2 #119bis-e draft R2-2210920

Online, 10th – 19th Oct, 2022

Agenda Item: 8.1.2

Source: ZTE Corporation

Title: Report of [AT119bis-e][NCR] NCR open issues (ZTE)

Document for: Discussion, Decision

# Introduction

This document is the report of the offline discussion on following aspects:

* Side control information signaling options (i.e. RRC vs. OAM)
* RRC states of NCR-MT
* Support of SRBs/DRBs
* NCR-Fwd ON/OFF
* SI impacts
* RRM functions
* [AT119bis-e][701][NCR] NCR open issues (ZTE)

Scope: see above.

Intended outcome: Report.

Deadline: W2 Tuesday

# Contact Information

|  |  |  |
| --- | --- | --- |
| Company | Name | Email address |
| Qualcomm | Georg Hampel | ghampel@qti.qualcomm.com |
| ZTE | LiuJing | liu.jing30@zte.com.cn |
| CATT | HaoXu | xuhao@catt.cn |
| Huawei, HiSilicon | Xubin | xubin10@huawei.com |
| Futurewei | Yunsong Yang | yyang1@futurewei.com |
| SungHoon Jung | SungHoon Jung | Sunghoon.jung@lge.com |
| CMCC | Jiayao Tan | tanjiayao@chinamobile.com |
| Apple | Zhibin Wu | zhibin\_wu@apple.com |
| vivo | Boubacar Kimba | kimba@vivo.com |
| Sony | Vivek Sharma | Vivek.sharma@sony.com |
| Intel | Ziyi | Ziyi.li@intel.com |
| Fujitsu | Takako Sanda | sanda.takako @ fujitsu.com |
| Ericsson | Felipe Arraño Scharager | felipe.arrano.scharager@ericsson.com |
| NEC | Satoaki Hayashi | Satoaki-hayashi@nec.com |
| China Telecom | Jincan Xin | xinjc@chinatelecom.cn |
| Samsung | Milos Tesanovic | m.tesanovic@samsung.com |
| Nokia | Andrew Lappalainen | [andrew.lappalainen@nokia.com](mailto:andrew.lappalainen@nokia.com) |
| Philips | Rob Davies | rob.j.davies@philips.com |
| Kyocera | Masato Fujishiro | masato.fujishiro.fj@kyocera.jp |

# Discussion

This document is to collect company views on the NCR open issues

## Side control information signalling options

According to the TR, there are 3 options for the NCR-MT to obtain the necessary configuration for receiving the L1/L2 signaling of the side control information.

- Option 1: The necessary configuration is from RRC.

- Option 2: The necessary configuration is from OAM or hard-coded.

- Option 3: The necessary configuration is partially configured by RRC and partially configured by OAM or hard-coded.

**Q1: Which option do companies prefer to configure NCR-MT for receiving L1/L2 signalling of side control information?**

|  |  |  |
| --- | --- | --- |
| Company | Option 1 (RRC);  Option 2 (OAM);  Option 3(RRC+OAM) | Comments |
| Qualcomm | Option 1 | L1/2 signaling (DCI, MAC CE) is always RRC-configured. OAM configuration is out of scope.  OAM should not be used for L1/L2 signaling configuration. |
| ZTE | Option 1 |  |
| CATT | Exclude Option2 | Option 1 can be used as baseline, and option3 can be FFS, which we think it is better to wait for more information from other groups. |
| Huawei, HiSilicon | Option 1 | According to the TR 38867, the “necessary configuration for receiving the L1/L2 signaling of the side control information” includes the following two aspects:   * The configurations of PHY channels to carry the L1/L2 signaling * The configurations of L1/L2 signaling   In our understanding, such configurations need to be changed dynamically according to the network condition, and thus should be configured by RRC naturally. |
| Futurewei | Option 1 | Option 1 is consistent with the second objective, which is RAN2-led, in the WID. |
| LGE | Option1 | Sidelink control information for NCR-Fwd is tightly related to IAB-MT configuration/operation. Hence, it is reasonable to use RRC as baseline (mandatory support) to signal the side control information.  If we allow OAM option for side control information, we wonder if there is a high risk of inter-operability and unnecessary market segmentation. |
| CMCC | Option 1 | Option 1 is more flexible. |
| Apple | Option 1 | We can agree to use RRC as baseline, as ensuring inter-vendor inter-operability will be challenging for OAM based solution. |
| vivo | Option 1 | L1/L2 side control information receiving should be regarded as a part of radio resource configuration for NCR-MT and RRC signaling is the preferred option to provide the related configurations. |
| Sony | Option 1 |  |
| Intel | Option 1 | From specification point of view, we only need to work on Option 1. Option 2 can be done implementation without specification work and can be considered outside of RAN2 scope. |
| Fujitsu | Option 1 or Option 3 | Reusing legacy RRC reconfiguration will be much easier than introducing completely new methods for side control information related configuration. |
| Ericsson | Option 1 | Note: We interpret the question to be about how the UE (AS) is configured to receive the side control information. Its not about how the side control information itself is sent. For example: (pending RAN1 progress) side control info may be provided by DCI, and necessary configuration to receive such DCI may be provided using RRC.  [Rapp-ZTE] Exactly right understanding.  Since most of the side control information needs to change in a dynamic or semi-static way, OAM is definitively not suitable for this purpose. RAN2 can take an initial assumption that carrying such information via RRC should be enough. However, RAN2 could wait for RAN1 progress before deciding if the configurations of side control information is carried in RRC, MAC CE, or DCI (or a combination of these).  Also, on whether OAM can be used to override some of the parameters/configurations provided by RRC, this should be discussed and decided in RAN3. |
| NEC | Option 1 | Considering gNB is in control of its radio resource and is responsible for all channel’s configurations, we think configured by gNB RRC is a proper way to go with. |
| China Telecom | Option1 | Since side control information changes frequently, it is hard to use a set of fixed parameters to configure all UEs camp on NCR. Therefore, Option 1 seems more flexible and reasonable |
| Samsung | Option 1 | Similar view as Huawei. |
| Nokia | Option 1 | Hard-coded solutions are not future proof, and it is unclear how OAM-based configurations can be made inter-vendor interoperable. Note: Option 1 does not preclude possibility of using NCR OAM in the upper layer, as long as the upper layer sends the information down to RRC. |
| Philips | Option 1 | Option 1 supports vendor interoperability and dynamic configuration. |
| Kyocera | Option 1 | We think the configuration for interface management, e.g., configuration for L1/L2 signalling, should be clearly specified for interoperability; thus, it should be done by RRC. |

**Summary：**

Option 1 is supported by large majority, some companies also suggest to clarify this question is about how to configure the NCR-MT to receive side control information, not about how the side control information itself is transmitted. To make it clear, rapporteur provides below proposal 1:

**Proposal 1 RAN2 confirms to use RRC signalling to configure NCR-MT to receive side control information. How the side control information itself is transmitted (e.g. via RRC or DCI or MAC CE) is up to RAN1.**

## RRC states of NCR-MT

Companies are invited to show your views on which RRC state(s) can be supported by NCR-MT.

* RRC\_CONNECTED;
* RRC\_IDLE;
* RRC\_INACTIVE

**Q2: Which RRC state(s) can be supported by NCR-MT?**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Company | applicable RRC states  (answer Yes/No/FFS) | | | Comments |
| RRC\_  CONNECTED | RRC\_  IDLE | RRC\_  INACTIVE |
| Qualcomm | Yes | Yes | Yes | Same as IAB-MT. |
| ZTE | Yes | Yes | FFS | We understand RRC\_INACTIVE state is not so important for NCR-MT because NCR-MT will not change its RRC state frequently and SDT seems not needed.  Currently, RRC\_INACTIVE is defined as mandatory feature with capability signalling， if most companies want to support RRC\_INACTIVE state, we suggest to change it into optional feature for NCR-MT. |
| CATT | Yes | Yes | No | In our understanding, the main principle of introducing RRC\_INACTIVE state is that the UE is able to return to the connected state quickly. Considering the C-link doesn’t need this requirement, we prefer not to support RRC inactive state in the current release. |
| Huawei, HiSilicon | Yes | Yes, but | FFS | Clarification is needed when NCR-MT should be in IDLE, e.g. whether it should be released to IDLE by the gNB deliberately and if so, in which case.  For RRC\_INACTIVE, more justification is needed. |
| Futurewei | Yes | Yes | FFS | For RRC\_INACTIVE state, we can wait for more RAN1 progress. |
| LGE | Yes for NCR-Fwd to work | No for NCR-Fwd to work | No for NCR-Fwd to work | To us, question is unclear but we assume that the question intends to ask which RRC state of NCR-MT is applicable for NCR-Fwd to operate properly.  [Rapp-ZTE] I would like to clarify the question is about whether which RRC states are applicable for NCR-MT.  Which RRC state the NCR-MT is in when NCR-Fwd is ON relates to Q4.  Like any other UEs, NCR-MT may go RRC\_IDLE/INACTIVE, but we assume that NCR-MT should be in RRC\_CONNECTED if NCR-Fwd is ON and functioning.  We can de-prioritize any optimization to support NCR-Fwd operation while NCR-MT is in RRC\_IDLE/INACTIVE. |
| CMCC | Yes | Yes | Yes | Similar to IAB-MT. The legacy procedures can be reused and no additional spec impact is needed. |
| Apple | Yes | Yes | FFS | To determine how RRC shall be tailored for NCR-MT, we need hold a consistent principle to determine which feature is necessary. We think RRC\_INACTIVE, cell selection, RRM measurements are all not needed for NCR. |
| vivo | Yes | Yes | Yes with comments | As NCR ON-OFF is one objective, RAN2 can justify whether RRC\_Inactive is supported to enable the NCR to quickly return to operating state, e.g. the NCR-MT return to RRC\_Connected state from RRC\_Inactive state. |
| Sony | Yes | Yes | Yes | NCR-MT should support all RRC states and avoid unnecessary optimisations. |
|  |  |  |  |  |
| Intel | Yes  (see comments) | Yes  (see comments) | Yes  (see comments) | Firstly, we don’t think this should be discussed first. We have to understand the signalling requirements and then discuss the states to be supported.  We think the protocol stack of NCR-MT function can follow legacy UE. With that, the existing principles and follow the existing specifications of RRC states and not make modifications to it specifically for NCR-MT function. Although the NCR-MT must be in RRC\_CONNECTED when it receives side control information, this does not mean the specification should prevent the NCR-MT from being in other states provided it is possible to transition back to connected sate when new signalling for NCR is needed. The RRC\_INCATIVE state may serve for the purpose to quickly return to connected state for side control information reception. All this can be left to implementation as it is currently up to network implementation on what RRC state to use.  [Rapp-ZTE] We share the similar view that existing principle and specifications should be reused as much as possible. And we agree it is up to NW implementation on the transition of RRC state.  However, it worth discussing whether RRC\_INACTIVE is really useful for NCR-MT, or whether it can be at least changed to Optional feature for NCR-MT, I understand the benefit is for simplification as you mentioned below.  Another potential reason to not consider RRC INACTIVE is for NCR-MT simplication (i.e., not support all the features of a UE). But that is a different discussion to be had later. |
| Fujitsu | Yes | Yes | FFS | For RRC\_INACTIVE, it may also be up to whether PDU session will be established for the NCR-MT. |
| Ericsson | Yes | Yes | FFS | There is no real benefit to bring the NCR-MT to RRC\_INACTIVE as the NCR-MT is not moving and the network is aware in which RNA or TA the NCS is.  The RRC\_INACTIVE state may be a quick transition to RRC\_CONNECTED in case a side control information should be send by the network but how much benefit this bring is questionable now. |
| NEC | Yes | Yes | maybe | From network energy saving point of view, if there is no UE connects to the cell via NCR, it is technically possible to neither exchange further side control information nor manage C-link/backhaul link, so NCR-MT’s RRC connection with the gNB could be either released to RRC idle or suspend to RRC Inactive. Compared to RRC idle, RRC Inactivate can restart side control information exchange and NCR context management quickly. |
| China Telecom | Yes | Yes | FFS | In our view, the RRC\_INACTIVE state is not so important for NCR as there is no need for NCR-MT to change its RRC state frequently. In addition, there is no other traffic/QoS flow except OAM traffic configured in NCR, indicating that NCR should not consider how to reduce the signaliing overhead for small data. Furthermore, if RRC\_INACTIVE is supported, it is also needed to discuss the behaviour of NCR-Fwd when NCR-MT enters RRC inactive. Therefore, the RRC inactive state of NCR-MT may be configured as optional. |
| Samsung | Yes | Yes but… | Yes but… | Regarding RRC\_IDLE, this state in our view is of least relevance to NCR-MT case, especially as there are concerns over the need for cell selection and RRM measurements. However, we would prefer to support RRC\_IDLE as-is for legacy UEs, rather than optimize it (add/remove features, or introduce new triggers).  With respect to RRC\_INACTIVE, we could consider ZTE’s proposal to make it optional. |
| Nokia | Yes | Yes | No | In our view RRC\_CONNECTED should be main operating mode of NCR-MT, with RRC\_IDLE only being used during initial access and as fallback error state. We do not see the need for RRC\_INACTIVE. NCR is expected to have a stable power supply and not subject to low power requirements. It is also not clear whether NCR-MT would be sufficiently responsive to dynamic side control signalling for the NCR-Fwd if NCR-MT needs to regularly transition from IDLE or INACTIVE back to CONNECTED. |
| Philips | Yes | Yes | Yes | We agree with Intel’s analysis. As NEC also observes, RRC\_INACTIVE offers a quicker return to action from a power-saving mode. |
| Kyocera | Yes | Yes | Yes | We don’t think INACTIVE state is useful for NCR, but at the same time, we think RAN2 does not need to do anything just to exclude INACTIVE state. So, we’re fine if INACTIVE is supported optionally. |

**Summary：**

* RRC\_CONNECTED: All support;
* RRC\_IDLE: All support;
* RRC\_INACTIVE:
  + Support: (9)
    - Qualcomm, LGE, CMCC, Vivo, Sony, Intel, Samsung, Philips, Kyocera
  + FFS: (8)
    - ZTE, Huawei, Futurewei, Apple, Fujitsu, Ericsson, NEC, China Telecom,
  + Not support: (2)
    - CATT, Nokia,

All companies agree that NCR-MT can support RRC\_CONNECTED and RRC\_INACTIVE states. For RRC\_INACTIVE state, companies views are divergent. 9 companies think RRC\_INACTIVE can be supported so that NCR-MT can switch to RRC\_INACTIVE state when there is no UEs connecting the cell via NCR, some companies also think the legacy procedure can be reused, there is no specification impact if supports RRC\_INACTIVE. 8 companies think the benefit of supporting RRC\_INACTIVE state for NCR-MT is unclear, because NCR-MT does not change its RRC state frequently, 2 companies think RRC\_INACTIVE should not be supported because NCR has stable power supply so that power consumption is not a big concern.

Based on the comments, rapporteur suggests to confirm the support of RRC\_CONNECTED and RRC\_IDLE states. For RRC\_INACIVE state, at least most companies commented that it can be optional for NCR, and RAN2 should try to avoid spending effort in studying new mechanism specifically for NCR-MT.

**Proposal 2 NCR-MT supports RRC\_CONNECTED and RRC\_IDLE states, FFS on RRC\_INACTIVE state (e.g. optional support or not support).**

## Support of SRBs/DRBs

Whether NCR-MT supports SRBs (i.e. SRB0/1/2) and DRB?

To facilitate the discussion, rapporteur has provided some information from other WG:

|  |
| --- |
| *#RAN3 online agreement made on Thursday 10-13:*  **The NCR-OAM connectivity requirement should be supported, further details can be discussed.**  Nok: This OAM requirement has no impact in RAN3 |

So RAN3 just agreed to support NCR-OAM connectivity requirement, as proposed by some companies, one possible way for transmitting OAM traffic from NCR-MT to gNB (or vice versa) is to establish a PDU-session over a DRB, similar to IAB.

**Q3: Whether SRBs and DRB are supported by NCR-MT?**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Company | Support of SRB/DRB  (answer Yes/No/FFS) | | | | Comments |
| SRB0 | SRB1 | SRB2 | DRB |
| Qualcomm | Yes | Yes | Yes | Yes | SRB0 and SRB1 are mandatory for RRC setup  SRB2 is mandatory for NAS.  DRB should be optional. It may be used to enable OAM connectivity via PDU session.  Note: The OAM connectivity REQUIREMENT implies that 3GPP has to support a mechanism for OAM connectivity. It does not imply that implementations have to use this mechanism. |
| ZTE | Yes | Yes | Yes | Yes | For DRB, we understand it is still a mandatory feature for NCR-MT, otherwise, we will introduce a new connection type which was not supported by legacy UEs (i.e. SRB0/1/2 but without DRB), and this may cause more specification impacts. |
| CATT | Yes | Yes | Yes | Yes | Thanks rapporteur providing the information about NCR-OAM connectivity requirement, hence we think it is reasonable to support DRB as well right now. |
| Huawei, HiSilicon | Yes | Yes | Yes | FFS | The NCR-OAM connectivity doesn’t necessarily reuqire the support of DRB. RAN2 may need to discuss more about what should be transmitted via the NCR-OAM connectivity.  [Rapp-ZTE] The content of NCR-OAM traffic is within RAN3’s scope. |
| Futurewei | Yes | Yes | Yes | Yes | Support of DRB can be optional. And, the number of DRBs supported by NCR-MTs can be significantly reduced. |
| LGE | Yes | Yes | Yes | Yes | The required number of DRBs to support may be relaxed for NCR-MT (e.g., only 1 DRB). |
| CMCC | Yes | Yes | Yes | Yes | It is reasonable to support DRB for transmitting OAM traffic. |
| Apple | Yes | Yes | Yes | FFS | It is not clear the OAM traffic using DRB is a hard requirement or not. |
| vivo | Yes | Yes | Yes | Yes | The motivation on the need of DRB seems not clear. To save standardization efforts, RAN2 can consider DRB as an optional feature for NCR-MT. |
| Sony | Yes | Yes | Yes | Yes |  |
|  |  |  |  |  |  |
| Intel | Yes | Yes | Yes | optional | We share the same view with QC, and think DRB can be optional. It is similar as IAB-node.  Not supporting DRB is for potential NCR-MT simplication (i.e., not support all the features of a UE). But that discussion can be had later. |
| Fujitsu | Yes | Yes | Yes | Yes | Establishing DRB could be optional like IAB-MT. |
| Ericsson | Yes | Yes | Yes | Yes | At most 1 DRB may be needed for OAM. |
| NEC | Yes | Yes | Yes | Yes | Share the same view with Qualcomm and ZTE. |
| China Telecom | Yes | Yes | Yes | Yes, but it is optional | Per RAN3 agreement, the NCR-OAM connectivity requirement should be supported. Considered the NCR could connect with OAM via fiber-optical or wired connection, the OAM traffic is optional for gNB.  SRB0 and SRB1 shall be support to transmit RRC messages before the RRC connection establishment.  According to TR38.876, as least for Solution 3 and Solution 4, the initial NAS message is needed for NCR authorization at CN side. Therefore, SRB2 should be supported. |
| Samsung | Yes | Yes | Yes | Yes | While DRB support may not be a pre-requisite for OAM to work, we still prefer to support DRBs. |
| Nokia | Yes | Yes | Yes | Yes | In our view RRC Connected will be default operating state of NCR-MT (as stated in response to Q2). SRB2 would be required for RRC re-establishment and DRB should be used for OAM. |
| Philips | Yes | Yes | Yes | FFS | Not clear if DRB is needed. |
| Kyocera | Yes | Yes | Yes  (Optional) | Yes  (Optional) | As the rapporteur analyzed, we think DRB is needed for OAM traffic. On the other hand, OAM support would be up to implementation, so we think DRB is optionally supported.  For SRB2, we think it’s needed if DRB is supported. In addition, we assume it depends on the solution for authorization and identification. |

**Summary：**

* SRB0: All support;
* SRB1: All support;
* SRB2: All support;mianyi
* DRB:
  + Support: (15)
    - Qualcomm, ZTE, CATT, Futurewei, LGE, CMCC, Vivo, Sony, Intel, Ericsson, NEC, China Telecom, Samsung, Nokia, Kyocera.
  + FFS: (3)
    - Huawei, Apple, Philips.

All companies agree that NCR-MT should support SRB0/1/2.

For DRB, majority companies agree to support DRB for the purpose of NCR-OAM connection, and some companies also think the DRB can be optional for NCR-MT (like IAB). 3 companies think whether to support DRB requires more discussion and they want to clarify what kind of information will be transmitted, and whether OAM traffic using DRB is the hard requirement.

Based on the majority, rapporteur suggests to confirm the support of DRB for NCR-MT. Regarding the comments on “optional”, we can further discuss it.

**Proposal 3 NCR-MT supports SRB0/1/2 and DRB. FFS whether DRB is optional feature for NCR-MT.**

## NCR-Fwd ON/OFF

Several companies propose to discuss the linkage between NCR-Fwd ON/OFF and the RRC state of NCR-MT, rapporteur has summarized them into following options:

* Option 1: When NCR-Fwd is ON, NCR-MT can be in any RRC states (e.g. RRC\_CONNECTED or RRC\_IDLE/INACTIVE);
* Option 2: When NCR-Fwd is ON, NCR-MT must be in RRC\_CONNECTED state; when NCR-MT is in RRC\_IDLE/INACTIVE states, NCR-Fwd must be “OFF”;
* Option 3: When NCR-Fwd is ON, NCR-MT must be in RRC\_CONNECTED state; when NCR-MT is in RRC\_IDLE state, NCR-Fwd must be “OFF”; when NCR-MT is in RRC\_INACTIVE state, NCR-Fwd can be “ON” or “OFF”;
* Option 4: Up to RAN1, considering RAN1 is discussing the fallback mechanism for NCR.

**Q4: Which option is preferred for the linkage between NCR-Fwd ON/OFF and the RRC state of NCR-MT?**

|  |  |  |
| --- | --- | --- |
| Company | Preferred Option | Comments |
| Qualcomm | Option 2 | ON/OFF is part of side control and therefore signaled on **slot-level time scale**. The NCR-MT must be **operational** when receiving side control signaling.  As the baseline, the NCR-MT is operational when RRC-CONNECTED.  The NCR-MT is certainly not operational and cannot receive side control in RRC-IDLE.  The question arises, if the NCR-MT could be operational in RRC-INACTIVE:   * What are the benefits? * How would it receive MAC-CE’s in this state? * How would it perform beam control, power control, etc on the BH link?   To keep things simple during the first NCR WI, we should assume that the NCR-MT can only receive side control including ON/OFF info when RRC CONNECTED. |
| ZTE | Option 4 | RAN1 is discussing the fallback mechanism for NCR, e.g. when the NCR-MT is in RRC\_IDLE/INACTIVE state, the NCR-Fwd can still “ON”, but it operates like a traditional RF-repeater (no side control information). See RAN1 agreements made last meeting:   |  | | --- | | The NCR-Fwd is always expected to be “OFF” unless otherwise explicitly or implicitly indicated by gNB.   * Note-1: This applies to the case regardless of the RRC state of NCR-MT. * Note-2: Indication (e.g., received when NCR-MT in RRC-connected) or DRX state of NCR-MT to control the ON-OFF behaviour of NCR-Fwd when the NCR-MT is in RRC-idle/inactive is not precluded.   The above is not meant to imply any signalling design for NCR-Fwd ON-OFF. |   From RAN2 perspective, we suggest to wait for RAN1 and then decide if there is any RAN2 impact. |
| CATT | Option 4 | Same view as ZTE. |
| Huawei, HiSilicon | Option 4 | To avoid duplicated discussion and contradictory solutions in RAN1 and RAN2, Better to wait for RAN1 first. |
| Futurewei | Option 4 | Or, if we want to capture any agreement made in RAN1 so far, it can be the following:  Option 5. When NCR-Fwd is OFF, NCR-MT can be in any RRC states (e.g. RRC\_CONNECTED or RRC\_IDLE/INACTIVE). |
| LGE | Option2 | We think Option 2 is a baseline and sufficient for R18.  Any optimization to support NCR-Fwd operations with NR-MT in RRC\_IDLE/ACTIVE can be considered in later releases. |
| CMCC | Option 4 | Share similar view with ZTE. |
| Apple | Option 1 or Option 4 | We think there is no need to entangle RRC state of NCR-MT with the operatios of NCR-fwd. But we are also fine to wait for RAN1. |
| vivo | Option 2 | Option 2 should be the baseline. |
| Sony | Option 4 | We are ok to wait for RAN1 |
| Intel | Option 4 | We share the same view that RAN1 is discussing this issue. However, we don’t think fallback mechanism is a common understanding in RAN1. We suggest to remove the 2nd half sentence in Option 4:   * Option 4: Up to RAN1, ~~considering RAN1 is discussing the fallback mechanism for NCR.~~ |
| Fujitsu | Option 4 | It will be better to wait for RAN1's decision.  However, according to our RAN1 colleagues, there is no discussion on fallback mechanism for NCR. We have the same suggestion with Intel. |
| Ericsson | Wait for RAN1 | (agree with Intel’s suggestion) |
| NEC | Option 4 with change | Suggest changing Option 4 to: waiting for RAN1 progress, considering RAN1 is discussing the fallback mechanism for NCR.  BTW, our understanding without considering fallback mechanism is   |  |  | | --- | --- | | NCR-Fwd | NCR-MT Status | | ON | RRC\_CONNECTED  or RRC-inactive (if supported) | | OFF | RRC\_Idle | |
| China Telecom | Option 4 | NW could indicate the NCR to “ON” in RRC\_idle state as RAN1 agreements. We can wait the progress of RAN1 and then analyses the impact on RAN2. |
| Samsung | Option 4 | Wait for RAN1. |
| Nokia | Option 2 | We are of the view that Option 2 should be treated as the baseline. Option 1 would require further study since it is not clear how effectively the NCR-Fwd can be configured with dynamic side control considering the state transition delays when NCR-MT transitions from RRC\_IDLE or RRC\_INACTIVE to RRC\_CONNECTED. Furthermore, if we assume NCR-MT only enters RRC IDLE when the C-link connection fails, then it is reasonable to assume the NCR-Fwd backhaul link is also poor and could be shut off as in Option 2. |
| Philips | Option 2 | We agree with Qualcomm’s analysis. |
| Kyocera | Option 2, and Option 1 | We think the gNB cannot control the NCR when the NCR-MT is in IDLE/INACTIVE, so Option 2 works as a fail-safe mechanism.  However, we assume Option 1 is useful in case the NCR-Fwd is working with (semi-)static configuration. So, we think the NCR needs to be indicated by the gNB whether the NCR-Fwd should be turned OFF or not, i.e., Option 2 or Option 1, when the NCR-MT transitions to IDLE/INACTIVE. |

**Summary：**

* Option 1: (2)
  + Apple, Kyocera;
* Option 2: (6)
  + Qualcomm, LGE, Vivo, Nokia, Philips, Kyocera,
* Option 3: (0)
* Option 4: (13)
  + ZTE, CATT, Huawei, Futurewei, CMCC, Apple, Sony, Intel, Fujitsu, Ericsson, NEC, China Telecom, Samsung,

6 companies agree with Option 2, but majority companies think this should be up to RAN1.

To avoid duplicated/conflicted discussion in two WGs, rapporteur suggests to wait for RAN1.

**Proposal 4 The association between RRC states of NCR-MT and NCR-Fwd ON/OFF is up to RAN1.**

## SI impacts

For legacy SIB configuration, companies are invited to check the following proposals:

* Proposal 1: NCR-MT should ignore cellBarred indication;
* Proposal 2: NCR-MT should ignore Unified Access Control (UAC) configuration;
* Proposal 3: NCR-MT should ignore cellReservedForOperatorUse, cellReservedForFutureUse，cellReservedForOtherUse and intraFreqReselection indications.

**Q5: Which proposal(s) do you support?**

|  |  |  |
| --- | --- | --- |
| Company | Supported proposals  (P1, P2, P3) | Comments |
| Qualcomm | P1, P2, P3 | Same as IAB |
| ZTE | P1, P2, P3 | Same as IAB |
| CATT | P1~P3 | Same as IAB |
| Huawei, HiSilicon | P1, P2, P3 | Same as IAB |
| Futurewei | P1, P2, P3 | Agree with above companies. |
| LGE | P1, P2, P3 | We understand that these three proposals are to mimic IAB-MT behaviors that are meant to exempt IAB-MTs from access control meant for UEs.  In addition, we think something similar to ‘iab-Support’ indication needs to be introduced for NCR per PLMN/NPN. |
| CMCC | P1, P2, P3 | Same as IAB. |
| Apple | P1, P2, P3 |  |
| vivo | P1,P2, P3 |  |
| Sony | P1-P3 | Same as IAB |
| Intel | P1-3 | Same as IAB |
| Fujitsu | P1, P2, P3 | Same as IAB |
| Ericsson | P1, P2, P3 |  |
| NEC | P1, P2, P3 | Same as IAB |
| China Telecom | P1, P2, P3 | Same as IAB |
| Samsung | P1 – P3 | Same as IAB. |
| Nokia | P1, P2, P3 | It makes sense to take a similar approach as IAB. |
| Philips | P1, P2, P3 |  |
| Kyocera | P1, P2, P3 | We think the NCR is considered as a network node, so it does not make sense to follow the access restriction mechanisms for the UE. We prefer to keep the commonality with the IAB-MT as much as possible. |

**Summary：**

All companies agree with P1, P2 and P3.

**Proposal 5 NCR-MT should ignore cellbarred, cellReservedForOperatorUse, cellReservedForFutureUse，cellReservedForOtherUse, intraFreqReselection indications and UAC configuration if broadcast in system information.**

## RRM functions

For the following RRC functions, which one(s) should be or can be supported by NCR-MT?

* C1: RRM measurements in RRC\_IDLE/INACTIVE;
* C2: RRM measurements in RRC\_CONNECTED;
* C3: Cell (re)selection;
* C4: Handover;
* C5: RLM;
* C6: BFD, BFR

Note: based on the progress in RAN4, most companies suggest to wait for RAN2 input.

**Q6: Which RRM functions should be or can be supported by NCR-MT?**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Company | Supported RRM functions  (answer Yes/No/FFS) | | | | | | Comments |
| C1 | C2 | C3 | C4 | C5 | C6 |
| Qualcomm | Optional | Optional | Mandatoary | Optional | Mandatory | Mandatory | C3 is necessary for NCR-MT to connect to the network.  C5 is necessary for NCR-MT to determine RLF, i.e., if it is operational or not.  C6 is necessary for the NCR-MT to keep the BH link stable  C1/C2/C4: This is not necessary for NCR operation. It can be optional and left up to implementation. |
| ZTE | Mandatory | Mandatory | Mandatory | Mandatory | Mandatory | Optional | C3 must be supported, so NCR-MT can select new cell when change its location;  C1 is the basis for supporting C3;  C4 is needed when operator/network wants to dynamically switch the NCR-MT to serve another overlapping cell or carrier;  C2 is the basis for supporting C4;  C5 must be supported, so NCR-MT can detect the radio link problem and reconnect if necessary;  C6 can be optional for NCR-MT if RLF is supported. |
| CATT | No | No | No | No | No | No | We think that NCR is mainly deployed by operator. And according to the WID, NCR is only single hop stationary network-controlled repeaters. Hence, cell (re)selection, handover RRM measurement may be unnecessary. Considering the cost of supporting more useless function, we prefer not need to support RRM measurement, cell (re-)selection and handover. For the other functions, we fail to see the necessity of mandatory requirement in the current release. |
| Huawei, HiSilicon | FFS | FFS | Yes for cell selection | No | FFS | FFS | * The cell selection in C3 should be supported for the NCR-MT to access a cell. * The cell re-selection in C3 should not be supported as the NCR doesn’t move. * C4 should not be supported as the NCR doesn’t move. * C1 should not be supported. According to 38.133, there is no requirement of RRM measurement on NCR-MT to perform cell selection. * C2 should not be supported as the NCR doesn’t move. * C5/C6 should be FFS in RAN2 and wait for RAN1 as at least BFD/RLM is up to RAN1. If BFD/RLM is supported by RAN1, RAN2 can further discuss BFR. |
| Futurewei | No | No | Yes | No | Yes | Yes | Per the WID, “For only single hop stationary network-controlled repeaters”, we think C3, C5, and C6 are sufficient for the operations of NCR-MT. C4, C1, and C2 are not needed and should be avoided to reduce complexity. |
| LGE | Dep. C3 | Dep.C4 | Yes for CS, FFS for CR | FFS | Yes | Yes | Mobility features (C3, C4) are not essential for NCR. But we need to further discuss if there is further complexity in supporting these? |
| CMCC | Yes | Yes | Yes | Yes | Yes | Yes | For C1~C4, share same view as ZTE. |
| Apple | No | No | No | No | FFS | FFS | For C1-C4, we think not necessary to be supported by NCR. |
| vivo | Yes | Yes | Yes | Optional | Yes | Yes | Except handover, that can be optional, other features should be considered. The environment change may affect the radio conditions of the BH link and control link, RRM/RLM and cell reselection can be helpful for unexpected radio condition changes. |
| Sony | Yes | Yes | Yes | Yes | Yes | Yes | We think all RRM functions should be supported like a normal UE. |
| Intel | No (see comments) | No  (see comments) | Mandatory (may require some modifications to existing specs) | No  (see comments) | Mandatory  (see comments) | Mandatory  (see comments) | Firstly, we haven’t discussed the relationship between NCR-MT cell and NCR-FWD cell. Without that, it is not clear what impact NCR-MT RLM has on NCR-FWD or whether this discussion is only related to NCR-MT communication with gNB or whether an RLM on the NCR-MT has any implications on the NCR-FWD handling.  **Our responses here are only from MCR-MT point of view. Relevance to NCR-FWD needs further discussion.**  [Rapp-ZTE] Just to confirm the discussion here is only about NCR-MT, not related to NCR-Fwd.  We don’t think handover should be supported as normally NCR is deployed by operator in a fixed location, which is covered by a fixed cell.  C3: to enable a standard solution for a NCR to join the corresponding gNB for coverage enhancement. We may need to ensure (depending on the relationship between NCR-MT cell and NCR-FWD cell) that NCR-MT selects a particular cell that is related to the NCR-FWD cell. This may require changes to the current cell (re)selection specification.  C5/6: to support detection of C-link, i.e. whether it is still stable to receive side control info, etc. |
| Fujitsu | No | No | Yes | No | Yes | Yes | As one of the focused scenarios for the NCR is "stationary", PCell change related functionalities will not be necessary.  In order to guarantee the reliable/robust communication between the gNB and the NC repeaters, BFD/BFR and RLM should be supported. |
| Ericsson | No | No | Yes | No | FFS | FFS | C1-C2: This seems completely unnecessary has the NCR is not mobility and there is no reason to allow the NCR-MT to perform measurements.    C3: When the repeater turns on and does initial access it needs to perform cell selection. In our mind cell reselection is basically the same procedure and may be needed as well, e.g. due to RLF (FFS).    C4: NCR is not mobile and thus there should be no handover.    C5-C6: This may be needed in case we want to allow some recovery mechanism for the NCR in case radio link problems are detected. However, this is too early to decide, and we can wait for some input from RAN1. |
| NEC | Mandatory | Optional | Mandatoary | Optional | Mandatory | Mandatory | Share the same view with QC that that C3, C5 and C6 should be supported. On C1, we also think it is the basis for supporting C3.  Considering that NCR is stationary network node, C2 and C4 could be optional for **simplification.** |
| China Telecom | Yes | Optional | Yes | Optional | Yes | Optional | C3 is necessary for NCR-MT to access a suitable cell;  C1 is the basis for supporting C3;  C2/C4 are not essential as the NCR doesn’t move.  C5 should be supported by NCR-MT to detect the radio link problem and reconnect the network if necessary;  C6 can be optional if RLF is supported by NCR. |
| Samsung | FFS | FFS | FFS | FFS | FFS | FFS | Similar view as ZTE, but are ok to discuss further. Hence FFS.  Need for HO is not clear for us, we need to confirm we are all on the same page regarding deployment scenarios. |
| Nokia | Yes | Yes | Yes | No | Yes | Yes | C2/C5/C6: We are of the view that NCR-MT will normally operate in RRC\_CONNECTED and want to minimize transition to IDLE state. C-link should therefore be robust.  C1/C3: Cell selection and associated measurements must be supported for initial access, while reselection could be optional (there may be some rare cases where reselection during RRC\_IDLE is advantageous, e.g. if coverage of main serving cell deteriorates and another candidate cell is available).  C4: Handover seems unnecessary since NCR is stationary. |
| Philips | Yes | Yes | Yes | Yes | Yes | Yes | Share ZTE’s views for 1-4 and Qualcomm’s for 5 and 6 |
| Kyocera | Yes | Yes | Yes | Yes | Yes | Yes | We think the existing functions are necessary at the end, especially when Control Link is established over FR2. Also, we don’t need any RAN2 effort just to exclude the existing functions. Though, we’re fine that some of these functions can be optional, for the cost reduction. |

**Summary：**

Besides whether to support these RRM functions, several companies also indicated their preference on the mandatory/optional aspects. However, not all companies expressed their preference on the “mandatory/optional”. At this stage, rapporteur suggests to first discuss the applicability, whether the feature is mandatory or optional can be discussed next step.

* **C1: RRM measurements in RRC\_IDLE/INACTIVE;**
  + Support: (10)
    - Qualcomm, ZTE, CMCC, Vivo, Sony, NEC, China Telecom, Nokia, Philips, Kyocera,
  + Not support: (5)
    - CATT, Apple, Intel, Fujitsu, Ericsson,
  + FFS: (3)
    - Huawei, Futurewei, Samsung,
* **C2: RRM measurements in RRC\_CONNECTED;**
  + Support：(10)
    - Qualcomm, ZTE, CMCC, Vivo, Sony, NEC, China Telecom, Nokia, Philips, Kyocera,
  + Not support: (6)
    - CATT, Futurewei, Apple, Intel, Fujitsu, Ericsson,
  + FFS: (2)
    - Huawei, Samsung,
* **C3: Cell (re)selection;**
  + Support：(16)
    - Qualcomm, ZTE, HW (only CS), Futurewei, LGE, CMCC, Vivo, Sony, Intel, Fujitsu, Ericsson, NEC, China Telecom, Nokia, Philips, Kyocera,
  + Not support: (2)
    - CATT, Apple,
  + FFS(1)
    - Samsung
* **C4: Handover;**
  + Support：(9)
    - Qualcomm, ZTE, CMCC, Vivo, Sony, NEC, China Telecom, Philips, Kyocera,
  + Not support: (9)
    - CATT, Huawei, Futurewei, LGE, Apple, Intel, Fujitsu, Ericsson, Nokia,
  + FFS(1)
    - Samsung
* **C5: RLM;**
  + Support：(14)
    - Qualcomm, ZTE, Futurewei, LGE, CMCC, Vivo, Sony, Intel, Fujitsu, NEC, China Telecom, Nokia, Philips, Kyocera,
  + Not support: (1)
    - CATT
  + FFS: (4)
    - Huawei, Apple, Ericsson, Samsung,
* **C6: BFD, BFR**
  + Support：(14)
    - Qualcomm, ZTE, Futurewei, LGE, CMCC, Vivo, Sony, Intel, Fujitsu, NEC, China Telecom, Nokia, Philips, Kyocera,
  + Not support: (1)
    - CATT
  + FFS: (4)
    - Huawei, Apple, Ericsson, Samsung,

Most companies agree that cell (re)selection, RLM and BFD/BFR can be supported by NCR-MT.

For RRM measurements in RRC\_IDLE/INACTIVE and in RRC\_CONNECTED, most companies think these features are applicable to NCR-MT, some companies also indicated these features can be optional for NCR-MT, but some companies think these features are not needed because the NCR-MT is stationary.

Rapporteur suggests to discuss them further. For reference, rapporteur wants to mention that RRM measurements and handover are already supported by IAB-MT.

**Proposal 6 From RAN2 perspective, the following RRM functions are applicable to NCR-MT:**

* **Cell (re)selection;**
* **RLM;**
* **BFD, BFR;**
* **FFS the applicable features are mandatory or optional;**

**Proposal 7 To discuss whether the following RRM functions are applicable to NCR-MT:**

* **RRM measurements in RRC\_IDLE and RRC\_INACTIVE (if supported);**
* **RRM measurements in RRC\_CONNECTED;**
* **handover;**

# Conclusion

Based on companies’ input, proposals are listed as follows.

**Proposal 1 RAN2 confirms to use RRC signalling to configure NCR-MT to receive side control information. How the side control information itself is transmitted (e.g. via RRC or DCI or MAC CE) is up to RAN1.**

**Proposal 2 NCR-MT supports RRC\_CONNECTED and RRC\_IDLE states, FFS on RRC\_INACTIVE state (e.g. optional support or not support).**

**Proposal 3 NCR-MT supports SRB0/1/2 and DRB. FFS whether DRB is optional feature for NCR-MT.**

**Proposal 4 The association between RRC states of NCR-MT and NCR-Fwd ON/OFF is up to RAN1.**

**Proposal 5 NCR-MT should ignore cellbarred, cellReservedForOperatorUse, cellReservedForFutureUse，cellReservedForOtherUse, intraFreqReselection indications and UAC configuration if broadcast in system information.**

**Proposal 6 From RAN2 perspective, the following RRM functions are applicable to NCR-MT:**

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* **RRM measurements in RRC\_IDLE and RRC\_INACTIVE (if supported);**
* **RRM measurements in RRC\_CONNECTED;**
* **handover;**